

Role of diffusion weighted imaging in the evaluation of extra axial intracranial tumors

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Abstract

The role of Diffusion Weighted Magnetic Resonance Imaging in the evaluation of various intracranial lesions has been evolving and increasing since its initial introduction as newer uses are being explored constantly. We review the imaging features of 41 cases of extra axial intracranial tumors and evaluate the role of diffusion weighted imaging in their diagnosis. Diffusion weighted imaging provides additional information in differentiating various intracranial tumors, in differentiating arachnoid cysts from epidermoid cysts, defining cystic/necrotic components of tumors.

Key Words: Apparent Diffusion Coefficient (ADC), Central Nervous System (CNS), Diffusion Weighted Imaging (DWI), Magnetic Resonance Imaging (MRI).

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INTRODUCTION

The role of Diffusion Weighted Magnetic Resonance Imaging in the evaluation of various intracranial lesions has been evolving. Though, initially DW MRI was introduced for the early detection of stroke, now it has got various other clinical applications¹. DW MRI is a relatively recent imaging technique in which water self-diffusion is a source of contrast on MR images. DWI measures Brownian motion of water molecules within the tissue². Molecular water proton diffusion process occurring on a micron scale is imaged non invasively and accurately without the use of any exogenous contrast. Erwin Hahn first described the effect of molecular diffusion on the NMR signal³.

MATERIALS AND METHODS

Patient Selection: 61 Patients were included in our study aged between 15 to 75 years who presented with neurological deficits. Patients were taken up for a

preliminary screening CT brain. DW MRI was performed in 61 patients.

Exclusion Criteria: 20 patients were excluded from the study based on exclusion criteria either before or after performing DW MRI.

Method of collection of data

Study Design: Prospective cross sectional study

Study Sample: 61 patients.

Study Period: February 2013 to August 2014

Study Area: Department of Radiodiagnosis, Gandhi medical college, Secunderabad.

Study Equipment: SIEMENS MAGNETOM AVANTO 18 CHANNEL 1.5 T MRI.

Ethical clearance from institutional ethics committee has been obtained.

Investigation Protocol: For diffusion weighting the matrix was usually 128x128 and FOV was 21cm. TE and TR were 117 and 3600 respectively. b values used were 0, 500, 1000 s/mm² and the gradients were applied in three orthogonal directions and trace images were obtained. The lesions were also characterized based on their intensity on DWI as well as ADC maps into hypo, iso and hyperintense. Histopathology was correlated with radiological diagnosis. Sensitivity and specificity were calculated.

OBSERVATIONS AND RESULTS

In the present study, peak age group is between 45-54 years. Of the 41 patients, males comprised majority of the present study group (51.47%) followed by females (48.53%). In this study seizures was the most common

presenting symptom (51.5%) followed by headache (48.5). In the present study, meningiomas were most common tumour followed by pituitary macroadenoma. In the present study, most common side involved was the right. In our study 35 cases (51.47%) were homogeneously hyperintense on T2WI and 17 cases

(25%) were heterogeneously hyperintense on T2WI. Mass effect was seen in 33 cases (48.52%). On contrast administration there was homogeneous enhancement in most cases comprising mainly of meningiomas. In our study the sensitivity in diagnosing extra axial tumors was 85.3%.

CASE 1

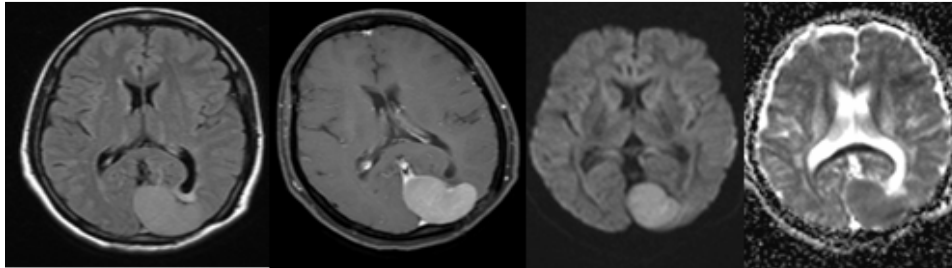


Figure 1

Well defined, extra axial, T1WI/T2WI/FLAIR isointense lesion seen in left occipital region. Post contrast, intense homogeneous enhancement seen. On DWI, lesion is hyperintense, lesion is hypointense on ADC map - MENINGIOMA.

CASE 2

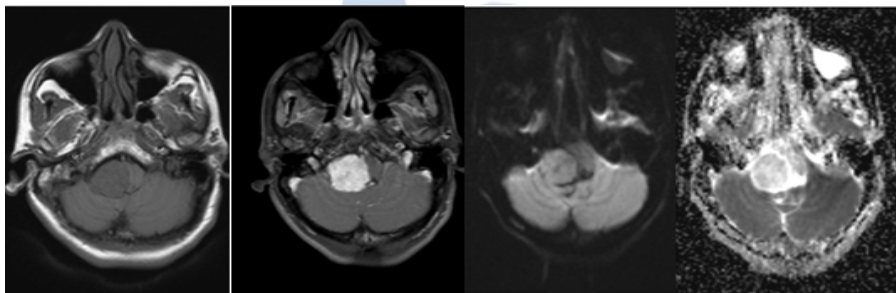


Figure 2:

Well defined, extra axial, T1WI isointense lesion seen in right CP angle. Post contrast, intense homogeneous enhancement seen. On DWI and ADC map the lesion is isointense - MENINGIOMA.

Table 1: Comparative evaluation of DWI in meningioma

Author	No of cases	DWI Hyper I	DWI Iso I	DWI Hypo I
Christopher G Filippi et al(4)	17	4(ADC Hypo I)	8 (ADC Iso I)	5 (ADC Hyper I)
Sherif A. Khedr et al(5)	31	19	9	3
Present study	16	9	5	2

CASE3

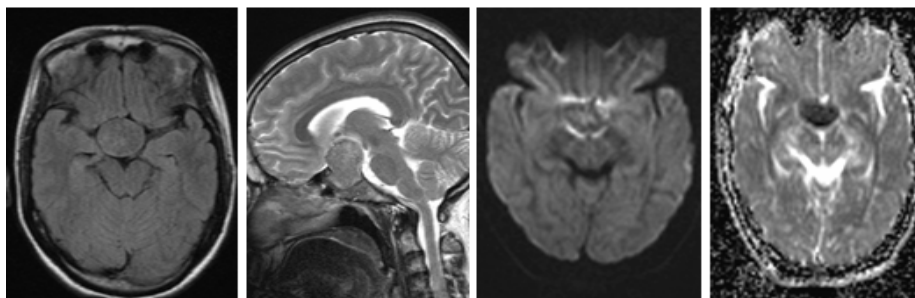


Figure 3:

T1WI/T2WI/FLAIR isointense lesion in sella extending into suprasellar region. Post contrast, heterogeneous enhancement seen. On DWI, lesion shows central restriction. On ADC map, lesion is hypointense. - PITUITARY MACROADENOMA.

Table 2: Comparative evaluation of DWI in pituitary macroadenoma

Author	No of cases	DWI Hyper I	DWI Hypo I
Faten Fawzy et al(6)	30	27(ADC Hypo I)	3 (ADC Hyper I)
Present study	9	8	1

CASE 4

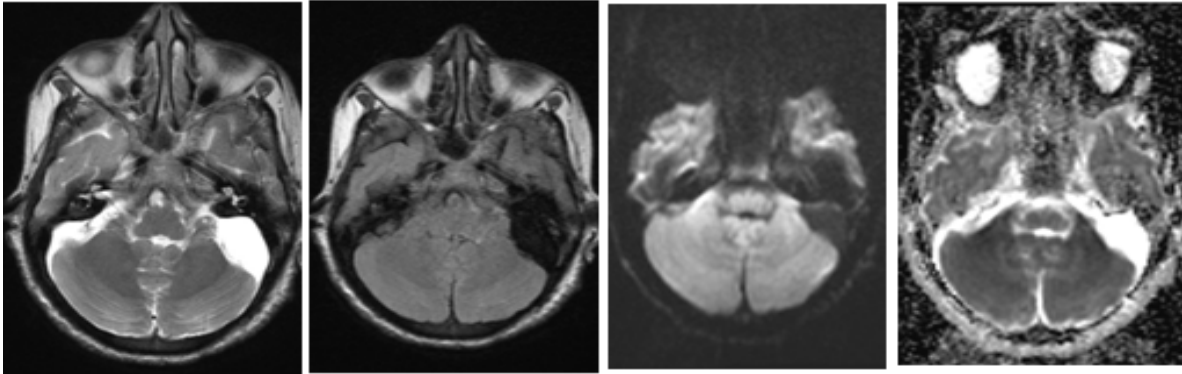


Figure 4:

T1WI/FLAIR hypointense, T2WI Hyperintense lesion in left CP angle. On DWI, lesion is hypointense and is hyperintense on ADC map, indicating absence of restricted diffusion - ARACHNOID CYST.

Table 3: Comparative evaluation of DWI in arachnoid cyst

Author	Number of Cases	DWI (low)	ADC(high)
Ahmed Farid et al(7)	9	9	9
Lai PH et al(8)	3	3	3
Present study	8	8	8

CASE 5

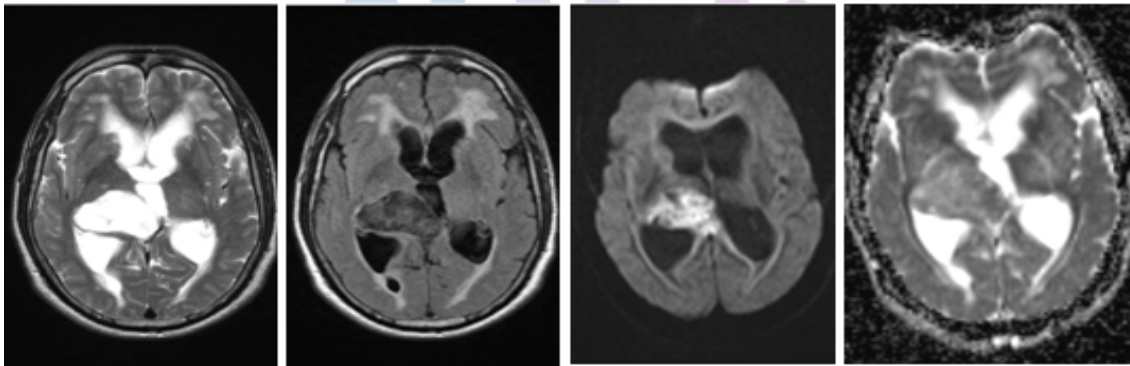


Figure 5:

Lobulated, T1WI hypointense, T2WI hyperintense lesion showing heterogeneous signal intensity on FLAIR, seen in right peri-mesencephalic region. On DWI, lesion is hyperintense - EPIDERMOID TUMOUR.

Table 4: Comparative evaluation of DWI in epidermoid tumour

Author	Number of cases	DWI SI(high)	ADC SI(low)
Ahmed farid et al	2	2	2
Lai PH et al	3	3	3
Sirin et al(9)	6	6	6
Hu XY et al(10)	6	6	6
Present study	4	4	4

Table 5: Comparative evaluation of arachnoid cyst vs epidermoid tumour

Pathological type	T1WI	T2WI	DWI	ADC	Number Present study	Number Study Ahmed et al
Arachnoid cyst	Low	High	Low	High	8	9
Epidermoid tumor	Low	High	High	Low	4	2

CASE 6

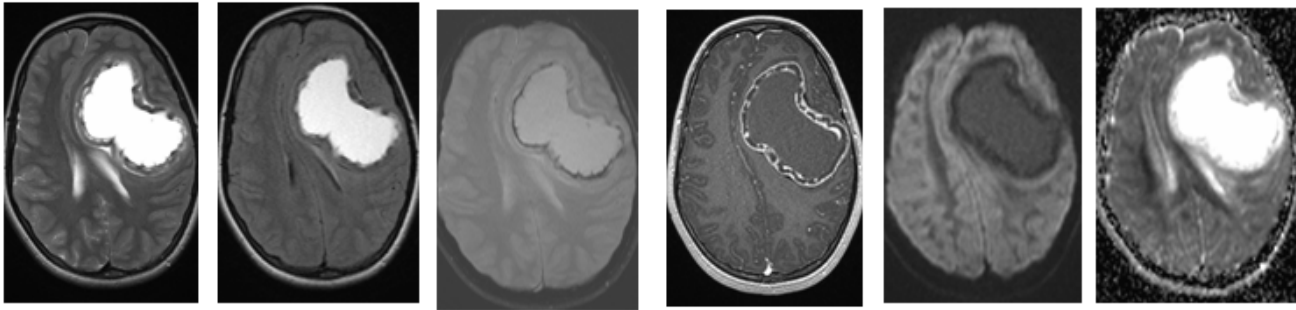


Figure 6:

T1WI isointense, T2WI/FLAIR hyperintense lesion, with thick peripheral hypointense wall which is showing blooming on GRE seen in left frontoparietal region, extra axial in location. Post contrast, peripheral rim enhancement seen. On DWI, lesion is hypointense, lesion is hyperintense on ADC map. Histopathology - MENINGEAL CHONDROMA. Rachid Gana *et al*¹¹ 2008, reported a case of Meningeal chondroma located in right frontal convexity which showed hypointense signal on T1WI, hyperintense signal on T2WI/FLAIR with peripheral rim enhancement. Lesion showed peripheral blooming on GRE indicating micro calcifications. However diffusion characteristics of the lesion were not specified. Najjar MW *et al*¹² 2014, reported another case of meningeal chondroma arising from left frontoparietal convexity showing hyperintense signal on T2WI/FLAIR with irregular rim enhancement. The lesion in the present study showed similar MR imaging features as the cases reported by Rachid Gana *et al* and Najjar MW *et al*.

DISCUSSION

During the period of nineteen months of the study, 41 cases were evaluated with MRI Brain with DWI. Maximum incidence of lesions was seen in the age group of 45-54 years with a male predominance. Majority of the patients presented with seizures (51.5%) followed by headache (48.5%). Frontal lobe was the most frequently involved region. DWI helped in differentiating arachnoid cysts from epidermoid tumors. Radiological diagnosis correlated well with histopathology in 27 out of 33 cases in the present study. No histopathological confirmation was obtained for 8 cases of arachnoid cysts.

CONCLUSION

Conventional MRI provides highly detailed anatomic information and has become a mainstay in the diagnosis of brain tumors. Diffusion weighted imaging provides

additional information in differentiating various intracranial tumors, in differentiating arachnoid cysts from epidermoid cysts.

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